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Carbon dioxide –significant emission sources and decreasing solutions

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Abstract

Many significant sources of pollution with gas emissions are affecting human health and damaging seriously fauna and flora. The atmosphere quality is influenced by gas emissions. In order to focus the CO_2 emissions, the paper asserts their main sources and solutions in decreasing the amount of this pollutant gas. The authors processed data found in recent professional literature based on interpolations and extrapolations, evaluating in an own conception the CO_2 content in Earth atmosphere, as well as the average global temperature. Conclusions highlight the importance and actuality of this theme.

Peer-review under responsibility of The Association "Education for tomorrow" / [Asociatia "Educatie pentru maine"].

*Keywords:*carbon dioxide; global warming; global temperature average; greenhouse effect; climate

1. Paper rationale

Life depends totally on atmosphere. The air contains around 0,03% carbon dioxide (CO_2), also named pollutant gas. A lot of fossil fuel is burned nowadays. This process delivers carbon which combines with air generating CO_2. Solar rays absorbed and delivered by Earth are blocked up by CO_2 creating a cover around the Earth, leading so to global warming (figure 1). Pollution and climate changes will lead to starvation (Europe Infomedium Revue, 2014).

Each year, around 30 billions tones of carbon dioxide are delivered in Earth atmosphere (Fulger Mariana, 2014).

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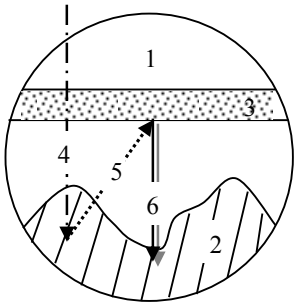

Fig. 1. Model regarding the CO_2 cover generation and the Earth warming (The Illustrated Scientific Encyclopedia, 2005)
1-atmosphere; 2-Earth; 3-CO_2 cover around Earth; 4-rays from the sun; 5-rays reflected, blocked by cover 3; 6-solar rays sent back on Earth

2. Paper theoretical foundation and related literature

To focus the CO_2 emissions, we expose bellow the main sources of CO_2 (figure 2), the electric equipment with domestic appliance (table 1), the stand-by electronic systems and the negative effects of climate changes (figure 3).

2.1. CO_2 emission sources

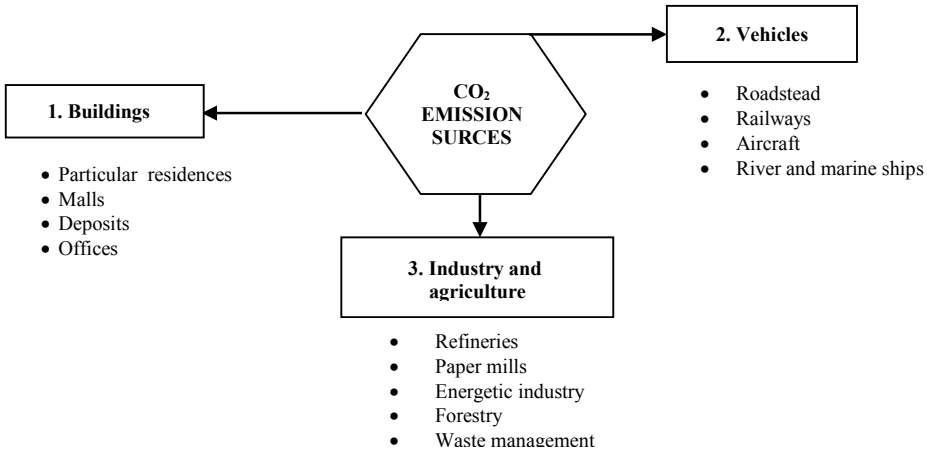

Fig. 2. Structure of carbon dioxide emission sources

2.2. Carbon dioxide emissions produced by electronic apparatus/ domestic appliances

Table 1. CO_2 annual emission ranking for the main electronic apparatus/ domestic appliances (equipment pamphlets, 2011-2014)

No.	Electronic apparatus/ domestic appliance	Percents of entire amount [%]	Annual quantity [kg CO_2/year]
1	Electric cloths dryer	43	690
2	Dishwashing machine	17	272
3	TV-set	15	249
4	Calculator	9	146
5	Microwave	5	81
6	Audio combine	5	76
7	Hair dryer	2	26
	TOTAL	100	1540

The accumulative world's appetite for energy has serious consequences on the Earth atmosphere's worming, producing global worming and climate changes.

Table 1 presents the CO_2 annual emission ranking for the main electronic apparatus/ domestic appliances.

Other fast absorbing equipment contributing to the CO_2 emission arising is:

- Personal laptop;
- Watch radio;
- Adaptor for apparatus such as: tensiometer, shaver and so on;
- Mobile charger;
- Wireless communications;
- Carbon monoxide detector (CO);
- Fume detector.

2.3. Electronic and domestic equipment in waiting mode (STAND-BY)

The **STAND-BY** (**SBY**) systems in waiting mode – **partial connected** to the energy resources in order to remain in stand-by, are micro consumers of electric energy. Some examples of such equipment remaining in stand-by when turned off: wireless communications, mobile phone, calculator, audio combine, the monitor and keyboard, the electric drains and breakers LED-s alight, **components forgotten in the breaker**. For example, a **TV-set** functions only 3 hours a day; during the rest of the 21 hours of that day, being in the stand-by mode, the **energy consumption** is about **40%** from the amount of that requested during its working (Science and Technique of the XX-th Century).

Another deficiency of the SBY components, beyond the **electric inutile consumption**:

- The electronic equipment could be **damaged during large multi-voltage**;
- The **electromagnetic field around the apparatus under voltage affects** the human body;
- Due to electromagnetic field created, **small carbon dioxide emissions** are produced.

2.4. Negative effects of climate changes

The phenomena consequences and effects of global worming are structured by the authors in figure 3.

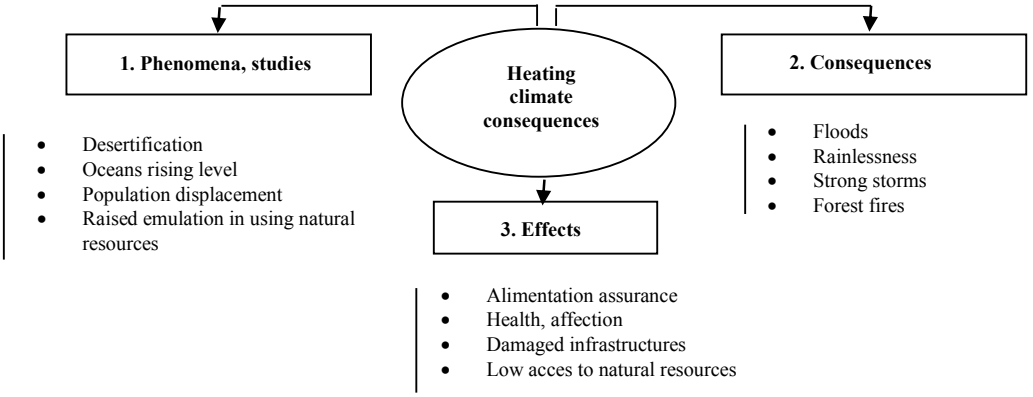

Fig. 3. Heating climate and consequences

Based on recent data found in professional literature (http://co2now.org/), the authors of this paper esteem for year 2045 a temperature raising of 0,0286 ^{0}C, namely a 2,5 times temperature raising towards year 1950 (0,0286/0,0146=2,502) (table 2 and graph in figure 5).

It has been globally calculated and/or estimated that, in the last 200 years, the Earth got warmer with 0,5 ^{0}C (14,5 ^{0}C – 14,0 ^{0}C, values shown in table 2).

In this rate of heating, if the value 0,5 ^{0}C/200 years is maintained, the authors esteem that in year 3000 the global temperature average in the atmosphere will be around 17 ^{0}C (2,5 ^{0}C/1000 years), situation in which the Earth could be impossible to live on (14,5 ^{0}C +2,5 ^{0}C=17 ^{0}C).

The following figure illustrates some main CO_2 emission sources in atmosphere.

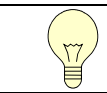	Bulb	Domestic lighting	1,6 tones of CO_2/year
	Car	10 000 km covered	3,0 tones of CO_2
	House	Domestic heating	4,5 tones of CO_2/year

Fig.4. Illustration of carbon dioxide emissions in Earth atmosphere (Europe Infomedium Revue, 2014)

3. Authors' contribution on the existing theory and practice in educational field

The authors' practical contributions in educational field are the connected issues given and studied at UTCB-DPPD within Technological Education classes, the students being trained to build papers on pollution subjects.

Several themes on the subject were developed under the authors' guidance regarding master and educational degree papers. In some of these works, the students were guided to carry out some measurements on water pollution, temperature average on ground having different coating (clay, asphalt, concrete), as well as in the air, in different conditions and locations.

The authors have published scientific communications (Bardescu, Legendi, 2010) and two articles in the AROTEM Monitor review (2010 and 2011) on the CO_2 issue. The papers focused aim the CO_2 emission reduction in construction equipment by replacing the fossil fuels and lubricants used now with bio-fuels and bio-lubricants.

4. Authors' contribution on the topic

By information gathered and calculus done by authors, there were established:

- ✓ The **carbon dioxide (CO_2) content** in the Earth atmosphere and the **global temperature average** (table 2 and figure 5)
- ✓ Average global values of CO_2 emissions, in **ppm** (parts per million) (table 2 and figures 5 and 6)

4.1. The CO_2 content and the global temperature average

Table 2. Carbon dioxide (CO_2) emissions in the Earth atmosphere and the global temperature average (Gridan T. and Ticleanu N., 2006)

No.	Year of measurement or estimation	CO_2 content, in ppm	Average global temperature of atmosphere, in ° C
1	1800	280^m	14,0^m
2	1950	315^m	14,4^x
3	2010	380^m	14,5^m
4	2045	450^x	14,6^x

Note: m) measurement; x) estimation/calculus

- **Borderline of the atmosphere global temperature**

It was estimated that global temperature average will raise from 14 ^{0}C in year 1800 to 14,6 ^{0}C in year 2045 (table 3); the value is closed to another one, mentioned in the specialized literature (Ungureanu, Ionel, 2006) for year 2050.

Over the temperature average value of 14,6 ^{0}C, the glacial blocks from Greenland and West Antarctica will melt, with disastrous consequences, such as the significant enhancing of sea and ocean levels. In this direction, an estimation regarding the Pacific Ocean shows a level enhancement of 1 m (mass media).

This issue is imposing many more researches, studies and experiments in order to reduce the gas emissions with greenhouse effect in the atmosphere; there was estimated that only applying drastic measures, these emissions could be reduced with 60…80% or, at least 40%.

- **Carbon released through fuel burning**

The **carbon** released through fossil fuel burning is raising the Earth temperature every moment.

The **organic carbon** released through **bio-fuels** burning is theoretically neutral regarding the carbon emissions because the organic carbon from bio-fuels comes from the atmosphere, being captured by plants in their raising period, a benefic process for the environment.

Experts in climatology (http:/co2now.org/) claim that until 2100 average temperature can raise with 1,4...5,8 ^{0}C .

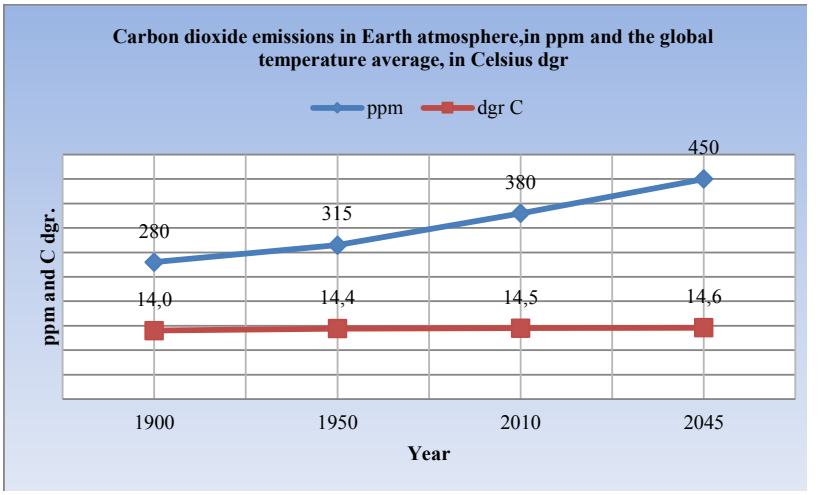

Fig.5. CO_2 emissions in Earth atmosphere and global temperature average (http://co2now.org/)

4.2. Average global values of CO_2 emissions in ppm (parts per million)

Carbon dioxide and its measuring (Bardescu, Legendi, 2011)

The carbon dioxide CO_2 –residual gas resulted following a process of burning solid, liquid or gas fuels- has a **high balance** in the Gas Emissions with Greenhouse Effect (GEGE) reaching the atmosphere.

In order to measure the carbon dioxide a **conventional measurement unit** is used, namely **ppm – emission parts of CO_2 per 1 million parts of Earth atmosphere**. The ppm unit allows the CO_2 estimation content in Earth atmosphere on certain periods of time, and the corresponding global temperature (figure 6 and table 2).

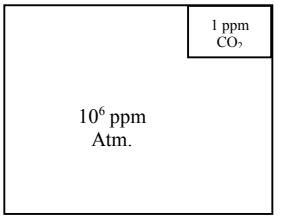

Figure 6. Measurement unit ppm defining (own conception)

- **Balance of CO_2**

It was measured (http://co2now.org/) that in this cadence, the CO_2 balance is raising with 2 ppm/year (table 3).

Table 3. Global temperature average, in ppm/year (own conception)

No.	Period of time	Timescale	Augmentation of ppm on timescale	Report ppm/no. years
	year	no. of years	ppm	ppm/year
1	1800-1950	150	35	0,2333
2	1950-2010	60	65	1,0833
3	2010-2045	35	70	2,0000

- **Admissible borderline of CO_2**

The admissible borderline of CO_2 in the atmosphere is estimated to be of 450 ppm (table 2).

- **The excess heat retained in atmosphere by CO_2**

The main gas responsible for the greenhouse effect is the carbon dioxide released through fossil fuels burning.
The excess heat retained in atmosphere by CO_2 is around **$2W/m^2year$**, corresponding to 2 ppm/a year, values estimated by the authors.

- **CO_2 density**

CO_2 density is 1,97 g/l gas.
1l essence……2,34 kg CO_2
1 m^3 natural gas……...2,00 kg CO_2
1 kWh natural gas……0,7 kg CO_2

- Four groups containing potential elements in CO_2 reduction are exposed in figure 7 (Bardescu, Legendi, 2011).

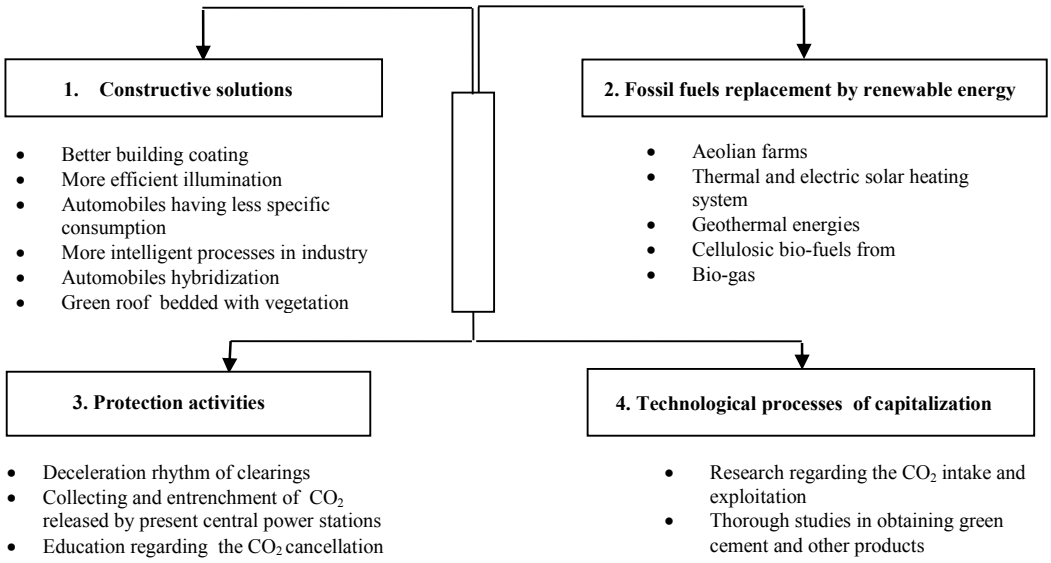

Fig. 7. Potential elements in reduction and even disposal of noxious carbon dioxide

- The main actions leading to reduction of pollutant emissions are shown in figure 8 (Bardescu, Legendi, 2011).

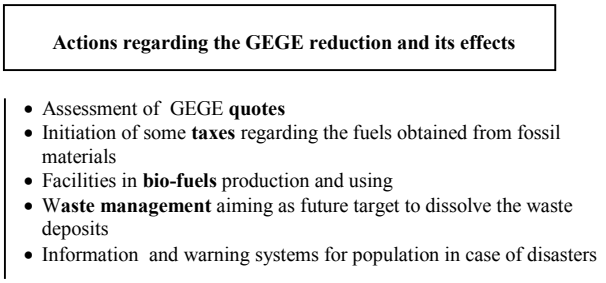

Fig. 8. Actions that may lead to GEGE reduction

- ✓ It is to mention that the authors have conceived all schemas and tables, defining all figures' contents and presenting them in a personal original manner/form.

5. Conclusions

- Producing and using renewable energy (solar, aeolian, biomass) and drastically reducing the use of fossil fuels interfering with ¾ in the CO_2 emissions
- Using establishments "passive house" type expending renewable energies
- Reducing CO_2 emissions up to 10% by decreasing the heating temperature in winter about 1^0C (Europe Infomedium Revue, 2014)
- The European Union ECO Directive, announced a year ago, on September the 1st, predicts all domestic electronic apparatus and equipment powered more than 1,6 kW to be gummed up. The aim is to reduce the specific energy as well as the CO_2 emissions.
- The Durable Energy Week held in 2014, the 23rd -29th of June, focused the energetic efficiency and the CO_2 reduction
- Human and/or animal diseases appearing as a result of global warming

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